

Claims

I claim:

1. An apparatus for passing electrical communication signals over valve control wires in an electronic irrigation system between a master data acquisition circuit and at least one slave active sensor circuits comprising:
 - (a) electronic irrigation control means for controlling the application of irrigation fluid over a given area; and
 - (b) at least one control valve driven by electrical current from said irrigation control means to control the flow of irrigation fluid to at least one dispersion nozzle; and
 - (c) electrical connection between said irrigation control means and said control valve for use in applying power to said control valves; said connection usually consisting of solid copper wire; and
 - (d) first instance of communications filter circuitry coupled to said electrical connection and located in the vicinity of said irrigation control means; and
 - (e) second instance of communications filter circuitry coupled to said electrical connection and located in the vicinity of where said irrigation fluid is dispersed.
2. The apparatus of claim 1 wherein first and second instances of said communication filter circuitry provides isolation from electrical voltages and currents used to power said control valve, comprising first and second capacitors configured to form a high pass filter which disallows the passage of valve power signals, yet allows higher frequency communication signals to pass through.

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3. The apparatus of claim 2 wherein first and second instances of said communication filter circuitry contain slew rate limiting circuitry, comprising a resistor and capacitor configured as a low pass filter, to prevent misfiring of solid state triac devices which may be used in said irrigation control means.
4. The apparatus of claim 2 wherein first and second instances of said communication filter circuitry contain at least one diode for overvoltage and undervoltage protection of said data acquisition circuit and said active sensor circuits.
5. The apparatus of claim 2 wherein first and second instances of said communication filter circuitry contain at least four terminals, two being connected to valve control wires, and two connected to sensor or data acquisition circuitry.
6. The apparatus of claim 1 wherein said electrical communication signals use a slow speed single bit encoding scheme to reduce the level of radio frequency emissions which may be generated during operation.
7. An apparatus for passing electrical communication signals over valve control wires in an electronic irrigation system between a data acquisition circuit and at least one passive sensor circuits comprising:
 - (a) electronic irrigation control means for controlling the application of irrigation fluid over a given area; and
 - (b) at least one control valve driven by electrical current from said irrigation control means to control the flow of irrigation fluid to at least one dispersion nozzle; and
 - (c) electrical connection between said irrigation control means and said control valve for use in applying power to said control valves; said connection usually consisting of solid copper wire; and

(d) communications filter circuitry coupled to said electrical connection and located in the vicinity of said irrigation control means; and

(e) passive sensor filter circuitry coupled to said electrical connection and located in the vicinity of where said irrigation fluid is dispersed.

8. The apparatus of claim 7 wherein said communications filter circuitry provides isolation from electrical voltages and currents used to power said control valve, comprising first and second capacitors configured to form a high pass filter which disallows the passage of valve power signals, yet allows higher frequency communication signals to pass through.

9. The apparatus of claim 8 wherein said communications filter circuitry contains slew rate limiting circuitry, comprising a resistor and capacitor configured as a low pass filter, to prevent misfiring of solid state triac devices which may be used in said irrigation control means.

10. The apparatus of claim 9 wherein said communications filter circuitry contains at least one diode for overvoltage and undervoltage protection of said data acquisition circuit.

11. The apparatus of claim 8 wherein said passive sensor filter circuitry provides isolation from electrical voltages and currents used to power said control valve, comprising first and second capacitors and a resistor configured to form a high pass filter which disallows the passage of valve power signals, yet allows higher frequency communication signals to pass through.

12. The apparatus of claim 7 wherein said electrical communication signals are not transmitted continuously, but are intermittent with a period of time between each

transmission sufficient to reduce to an acceptable level the radio frequency emissions which may be generated during operation.

13. A method for measuring resistance of a passive resistive sensor connected in parallel to valve control wires in an electronic irrigation system, the method comprising:

- (a) providing a stimulus signal which is passed through a series resistor for the purpose of creating a voltage divider with said resistive sensor; and
- (b) passing said signal through an isolation filter to said valve control wires, said isolation filter having first and second series capacitors configured to form a high pass filter for isolation from power voltages which may exist on valve control wires; and
- (c) said stimulus signal is a digital pulse of the proper magnitude and duration such that when it is passed to said valve control wires, the control valve which is connected in parallel briefly appears as a high impedance, such that for a small instant of time a voltage divider is created between the series resistor and resistive sensor; and
- (d) a high speed analog to digital converter is used to obtain a digital value of the voltage level that briefly exists in said voltage divider, further that said digital value is proportional to resistance level of said sensor,

whereby the resistance level of the sensor can be mathematically derived.

14. The method of claim 13, wherein said series resistor is connected with a capacitor in parallel to form a low pass filter, whereby the slew rate of said digital pulse is limited to less than 1 volt per microsecond to protect against premature firing of solid state triac devices generally used in irrigation control systems.

15. The method of claim 14, wherein said capacitor connected in parallel is ceramic about 1000 pico farads in size.

16. The method of claim 13, wherein the magnitude and duration of said digital pulse is around 5 volts and 30 microseconds, respectively.

17. The method of claim 13, wherein said passive resistive sensor is connected to said valve control wires through an isolation filter having first and second series capacitors configured to form a high pass filter for isolation from power voltages which may exist on valve control wires.

18. The method of claim 17, wherein said series capacitors for isolation are ceramic about 0.33 micro farads in size.

19. The method of claim 13, wherein said isolation filter contains a diode connected between said first and second series capacitors to provide overvoltage protection from transient voltage spikes and ac currents which may occur on said valve control wires.

20. The method of claim 13 wherein said stimulus signal is applied only intermittently, with a period of time between each stimulus signal, sufficient to reduce to an acceptable level the radio frequency emissions which may be generated during operation.